PATENT SPECIFICATION 1,122,616

DRAWINGS ATTACHED.

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1,122,616

Date of filing Complete Specification: 21 April, 1967.

Application Date: 2 May, 1966. No. 19247/66.

Complete Specification Published: 7 Aug., 1968.

Index at Acceptance:—F1 C(1K, 2F1, 2F2, D1B, D2G1, D2G2); B3 F(16A130, 16A166, 16B2C1).

Int. Cl.:—F 06 d 29/26.

COMPLETE SPECIFICATION.

Improvements in or relating to Fan Impellers.

We, AIRSCREW-WEYROC LIMITED, a British Company, of Weybridge, Surrey, England, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to fan impellers, and particularly but not necessarily to tapered aerofoil impellers for axial flow fans.

At present there are two basic types of impeller in use.

Where impellers of up to about six feet in diameter are required, they are frequently sand cast from aluminium alloy, a cast iron centre having a bore and keyway being incorporated at the time of casting.

This form of construction has a number of disadvantages. A flow in any part of the cast structure results in rejection of the whole impeller. As the size increases, the costs of patterns required for sand casting increase disproportionately. Furthermore, the plan form of the blades cannot overlap due to casting restrictions. This limits blade width.

In order to overcome these difficulties, and in order to enable impellers of larger dimensions to be constructed than is practicable by the sand casting process, the adjustable pitch impeller was developed. In this construction, the blades are individually preformed by gravity die casting and are provided with root portions of circular cross section having an annular recess for locking engagement with a clamp. The hub of the impeller is formed from a series of clamps bolted together and each having a blade root clamped therein. Impellers having varying numbers of blades and varying blade angles can thus be built from standard components.

[*Pr*

However, this form of hub construction is of an intricate form to which it is difficult to apply satisfactory protective coatings against corrosive atmospheres. Furthermore, areas of high stress concentration occur at the blade roots caused for example, by the provision of annular clamping recesses. Consequently, full advantage cannot be taken of the improved mechanical properties of die cast material over sand cast material.

The invention provides a method of constructing an axial flow or mixed flow fan impeller, comprising the steps of preforming a plurality of separate blades each having a root portion of smooth rounded form merging into a smooth neck, and casting a hub around the root portions whereby the root portions are immersed in and gripped by material of the hub; by making the blade root portions in this way stress concentrations in blade roots and hub are reduced to a minimum.

The invention further provides an axial flow or mixed flow fan impeller, comprising a plurality of preformed blades each having a root portion of smooth rounded form merging into a smooth neck which root portions are immersed in and gripped by the material of the hub which is cast around said root portions.

Each blade may be of die cast aluminium alloy. The root portion may be approximately elliptical in cross-section within part or all of the zone of envelopment of the hub casting, so as to prevent rotation of the blade when incorporated in the impeller.

The hub may be a sand or gravity casting of aluminium alloy and incorporate a centre insert having a bore and keyway and made of cast iron or other material suitable for such a duty by virtue of its hardness. The

invention is further illustrated by way of example in the accompanying drawings, in which:—

Figure 1 is a plan view of an impeller for an axial flow fan, constructed according to the invention;

Figure 2 is a sectional elevation on the line II—II of Figure 1, the blades however not being sectioned;

Figure 3 is a sectional detail on the line III—III of Figure 2, and

Figure 4 is a sectional detail on the line IV—IV of Figure 1, but showing a modified shape of the blade root portion;

Figure 5 is a diagrammatic illustration of the aerofoil section of a blade.

Referring to Figures 1 and 2 of the drawings, an impeller 1 comprises a number of aerofoil section blades 2 each having a root portion 3 enveloped in the metal of a cast hub 4.

The blades are first gravity die cast or formed from aluminium alloy. The hub 4 is then sand or gravity cast to incorporate the root portions 3 of the blades in the hub after they have been radially positioned as shown in Figure 1. Also incorporated in the hub during casting is a central cast iron insert 5 having a bore 6 and keyway 7 for securing the impeller on a shaft.

The insert 5 may alternatively be bolted or otherwise secured in the hub 4 subsequent to casting, suitable mountings being provided on the hub for this purpose.

Referring to Figures 3 and 4, the root portion of each blade has a circular cross section at 8 and tapers towards the tip of the blade as at 9 so as to provide a substantially elliptical cross section at 10 coinciding with the periphery of the hub 4. Radially outwardly of the position 10, the blade develops into a conventional aerofoil section as shown in Figure 5.

Although the invention is particularly applicable to impellers for axial flow fans, it may be used to advantage for constructing impellers for mixed flow fans.

Although particularly suited to light alloy impellers, the main advantages of the invention, *i.e.* elimination of regions of high stress concentration, and reduced size of basic parts as compared with one piece casting, are applicable to other materials *e.g.* ferrous alloys or plastics.

WHAT WE CLAIM IS:—

1. A method of constructing an axial flow or mixed flow fan impeller, comprising the steps of preforming a plurality of separate blades each having a root portion of smooth rounded form merging into a smooth neck, and casting a hub around the root portions whereby the root portions are immersed in and gripped by material of the hub.

2. A method as claimed in Claim 1, wherein the blade root portions have a part of non-circular cross-section within the zone of envelopment of the hub casting.

3. A method as claimed in Claim 2, wherein the non-circular blade root part is of substantially elliptical cross-section.

4. A method as claimed in any of the preceding claims, wherein the blades are cast.

5. A method as claimed in any of the Claims 1 to 4, wherein the blades are die-cast of aluminium alloy.

6. A method as claimed in any of the Claims 1 to 4, wherein the blades are forged from aluminium alloy.

7. A method as claimed in any of the Claims 1 to 6, wherein the hub is a casting of aluminium alloy incorporating a centre of hard material providing a bore and keyway.

8. A method as claimed in any of Claims 1 to 4 wherein the blades and/or the hub are formed of ferrous alloy.

9. A method as claimed in any of the Claims 1 to 4, wherein the blades and hub are formed of plastics material.

10. A method of making a fan impeller as herein described with reference to the accompanying drawings.

11. A fan impeller made by the method of any of the preceding claims.

12. An axial flow or mixed flow fan impeller, comprising a plurality of preformed blades each having a root portion of smooth rounded form merging into a smooth neck which root portions are immersed in and gripped by the material of the hub which is cast around said root portions.

13. A fan impeller substantially as herein described with reference to the accompanying drawings.

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Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1968.
Published at The Patent Office, 25 Southampton Buildings, London, W.C.2,
form which copies may be obtained.

Fig. 1.

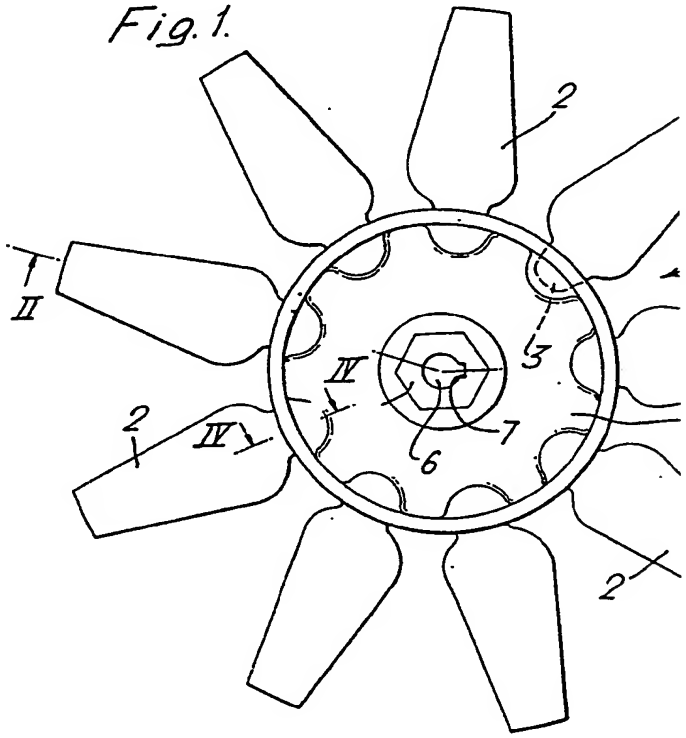
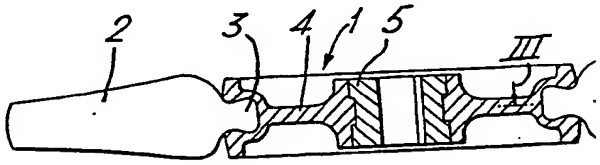


Fig. 2.



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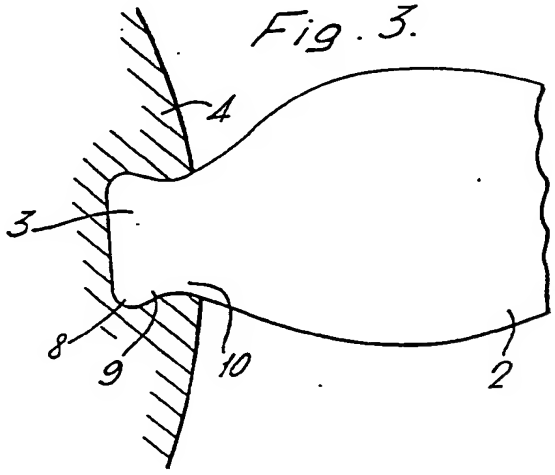
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheets 1 & 2

Fig. 3.



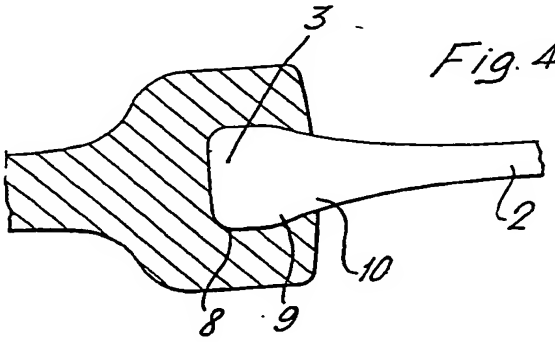


Fig. 4.

Fig. 5.

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Sheets 1 & 2

Fig. 1.

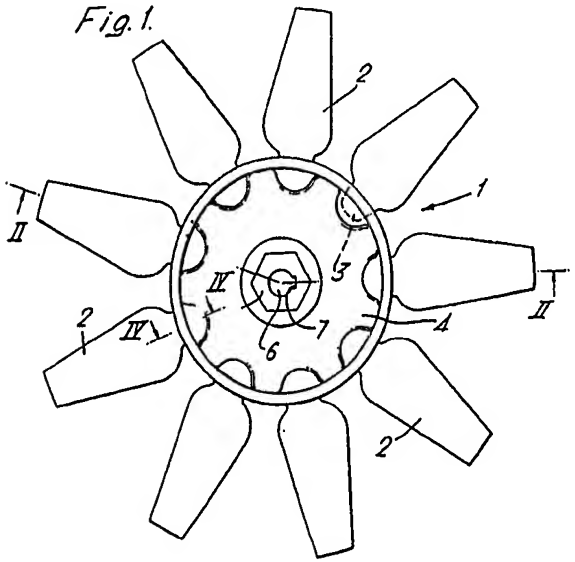

Fig. 3.

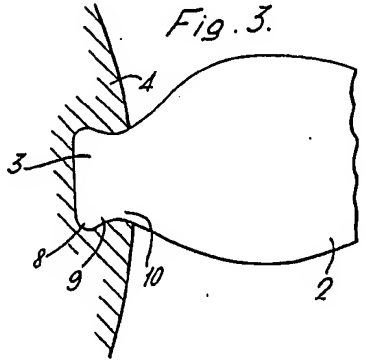

Fig. 4.

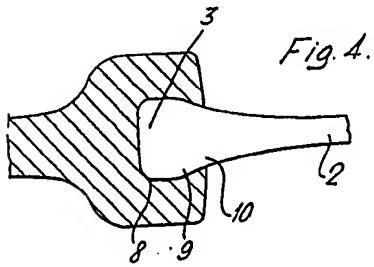

Fig. 2.

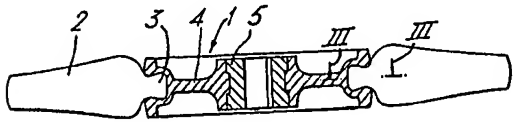

Fig. 5.